

Bay Bridge Update to CTC – August 6, 2013



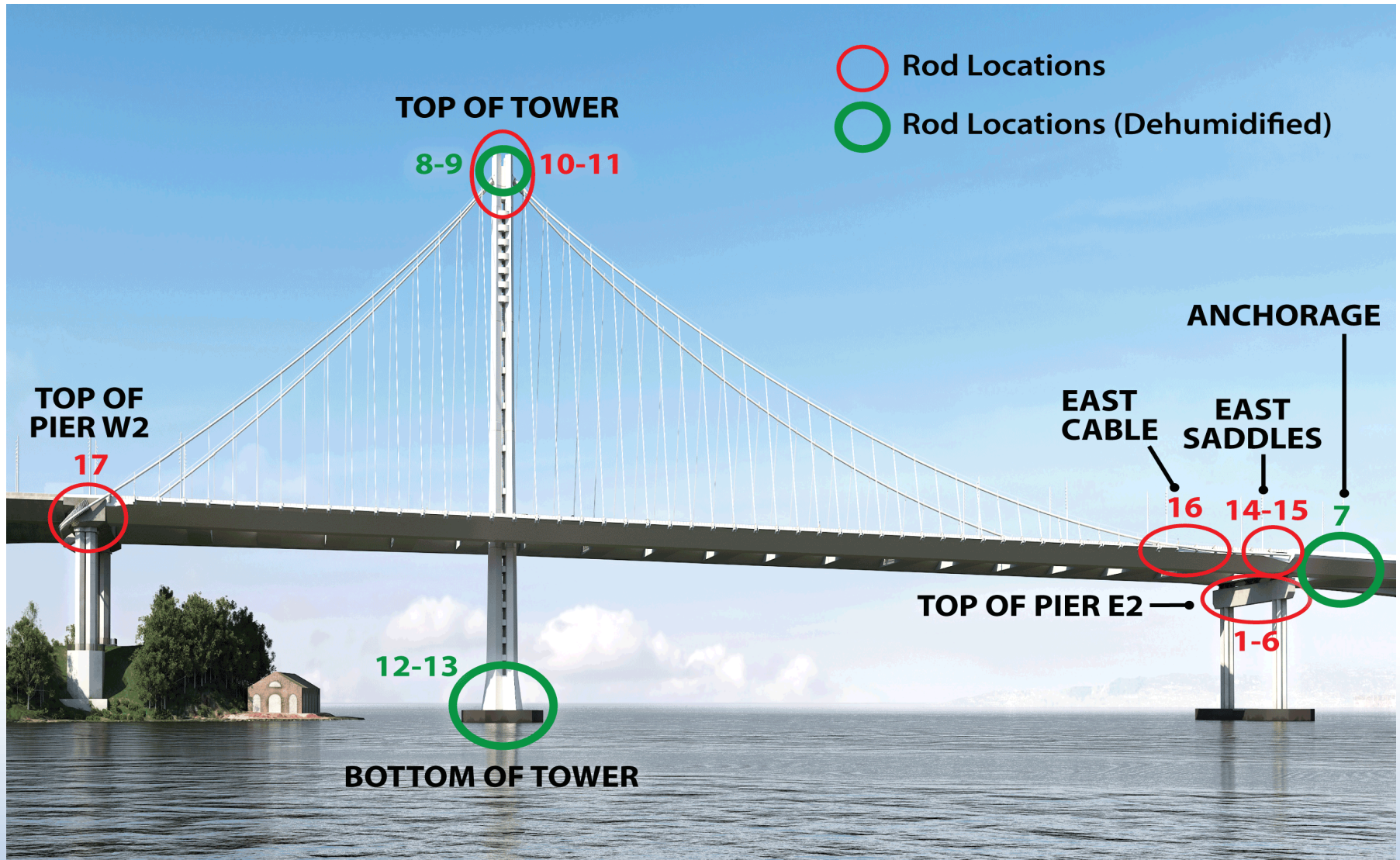
On July 8, 2013, TBPOC issued investigative report on A354 Grade BD High-Strength Steel Rods with findings and provisional resolution on SAS high-strength bolts



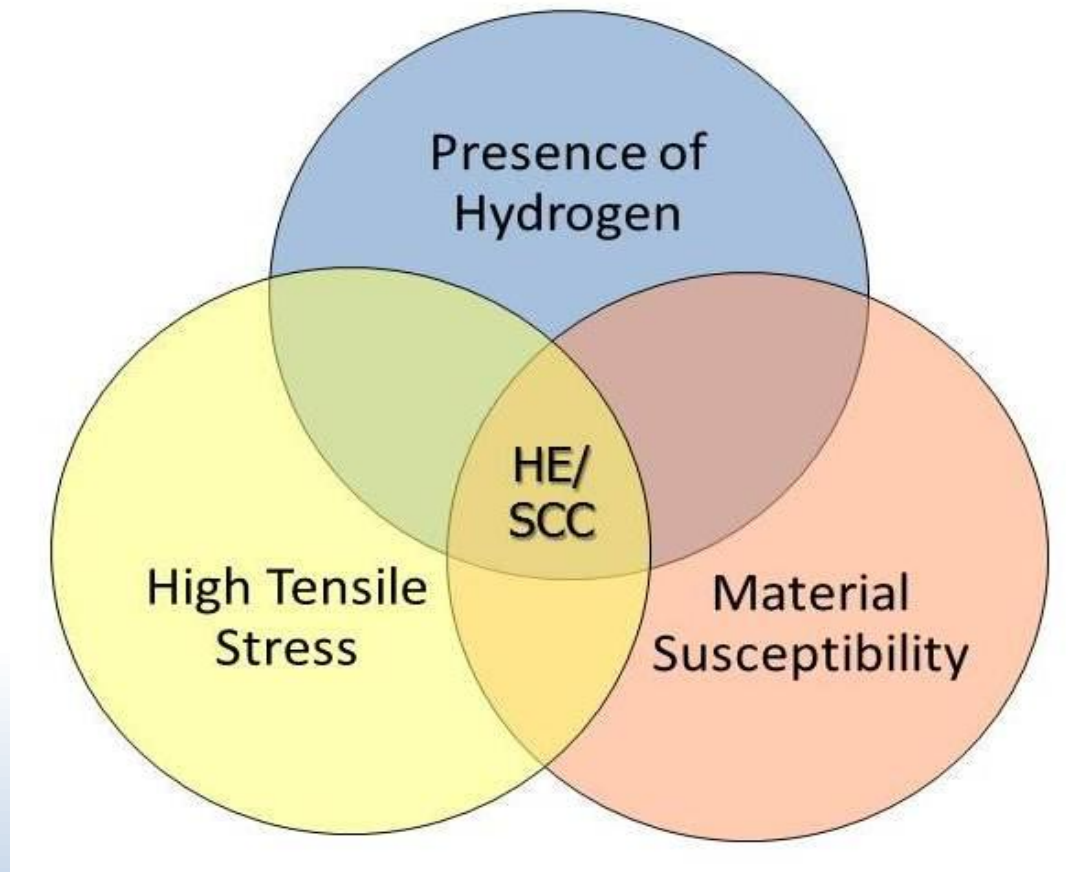
A354 Grade BD High-Strength Rods on the SAS Bridge

Item No.	Location	Component	Quantity Installed	Diameter (in)	Length (ft)	Tension (fraction of Fu*)
1	Top of Pier E2	Failed Shear Key Anchor Rods (2008)	96	3	10-17	0.7
2		Bearing & Shear Key Anchor Rods	192	3	22-23	0.7
3		Shear Key Rods (top)	320	3	2-4.5	0.7
4		Bearing Rods (top)	224	2	4	0.7
5		Bearing Assembly	96	1	2.5	0.6
6		Bearing Retainer Ring Plate Assembly	336	1	0.2	0.4
7	Anchorage	Parallel Wire Strands (PWS) Anchor Rods	274	3.5	28-32	0.3
8	Top of Tower	Saddle Tie Rods	25	4	6-18	0.7
9		Saddle Turned Rods	108	3	1.5-2	0.5
10		Saddle Grillage	90	3	1	0.1
11		Outrigger Boom	4	3	2	0.1
12	Bottom of Tower	Tower Anchor Rods (Type 1)	388	3	26	0.5
13		Tower Anchor Rods (Type 2)	36	4	26	0.4
14	East Saddles	East Saddle Anchor Rods	32	2	3	0.1
15		East Saddle Tie Rods	18	3	5	0.1
16	East Cable	Cable Band Anchor Rod	24	3	10-11	0.2
17	Top of Pier W2	Bikepath Anchor Rods	43	1.2	1.5	TBD
		TOTAL QUANTITY	2,306			

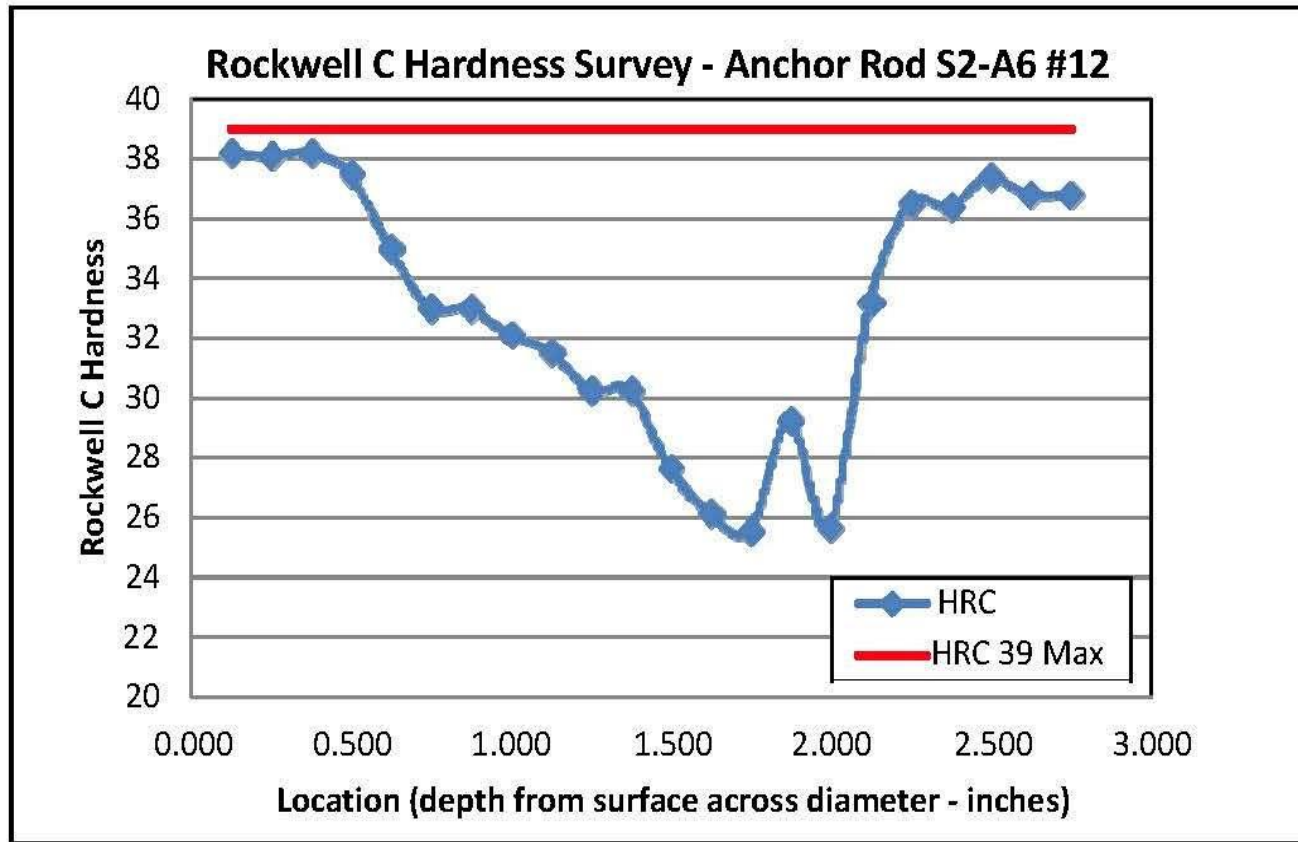
A354 Grade BD Rod Locations on the SAS Bridge



Causes of Hydrogen Embrittlement (HE) or Stress Corrosion Cracking (SCC)

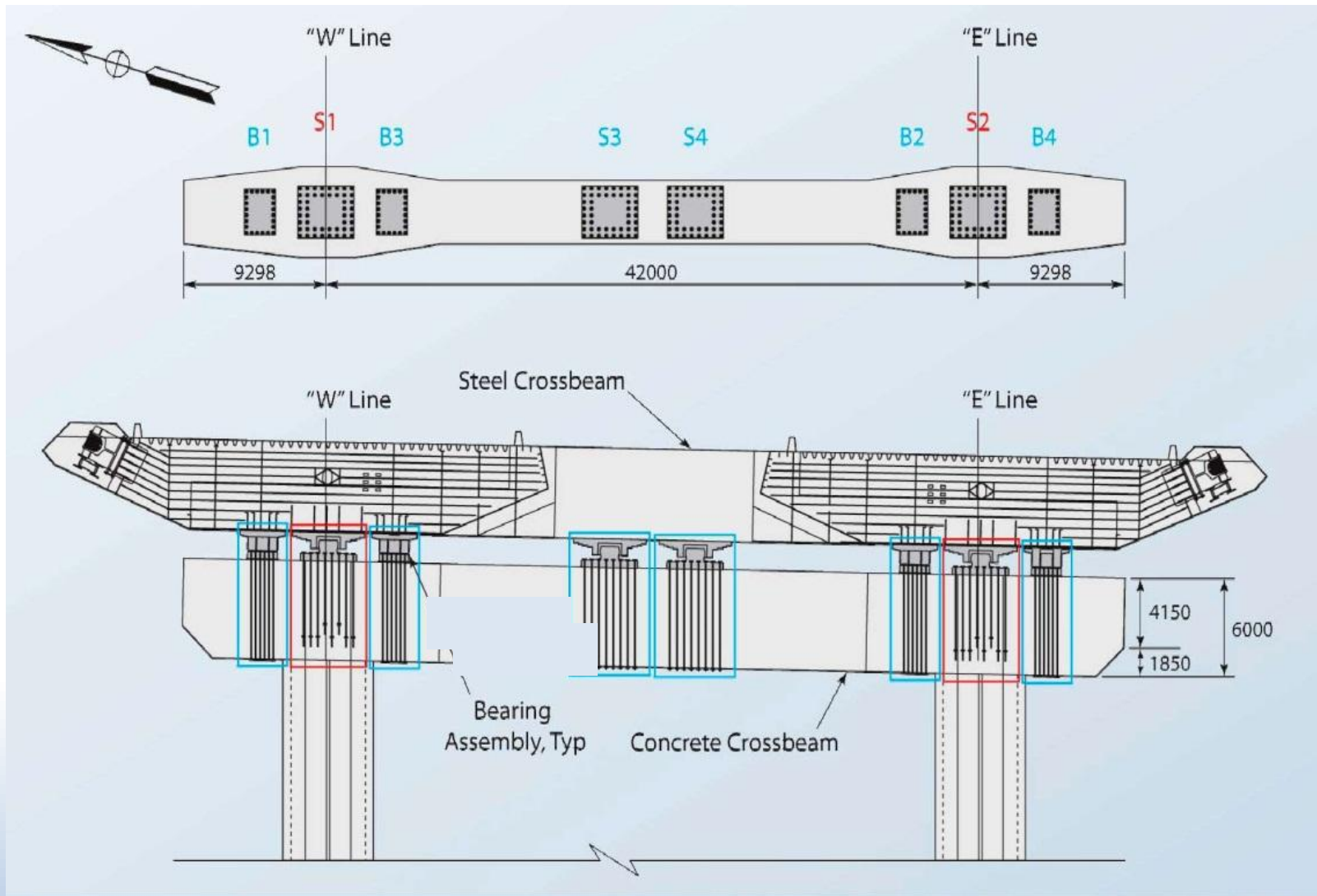


2008 Rods Failed Due to Hydrogen Embrittlement

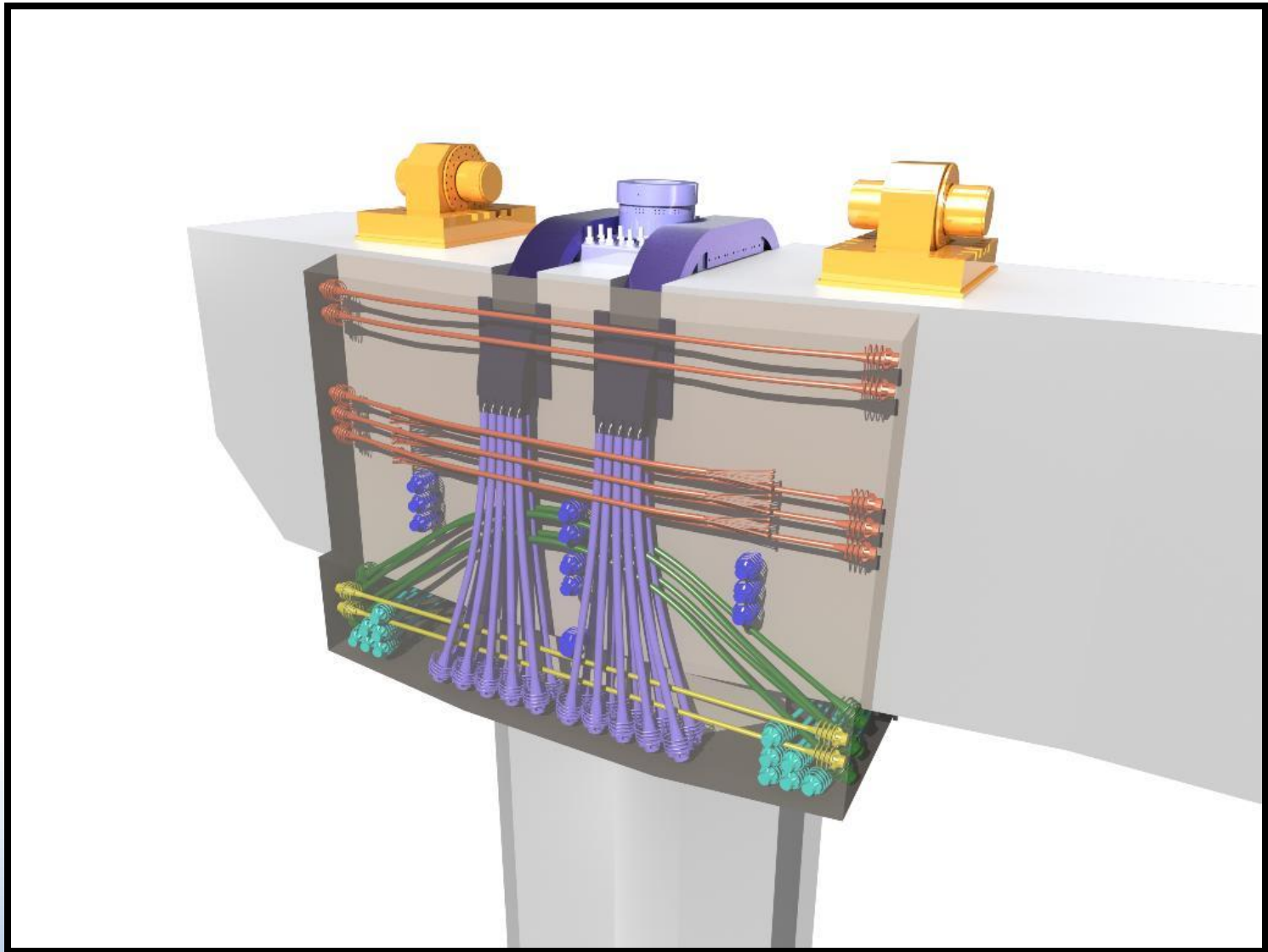


- Rods exhibited a material susceptibility to hydrogen embrittlement with a heterogenous structure and high surface hardness.

Bearings and Shear Keys on Pier E2

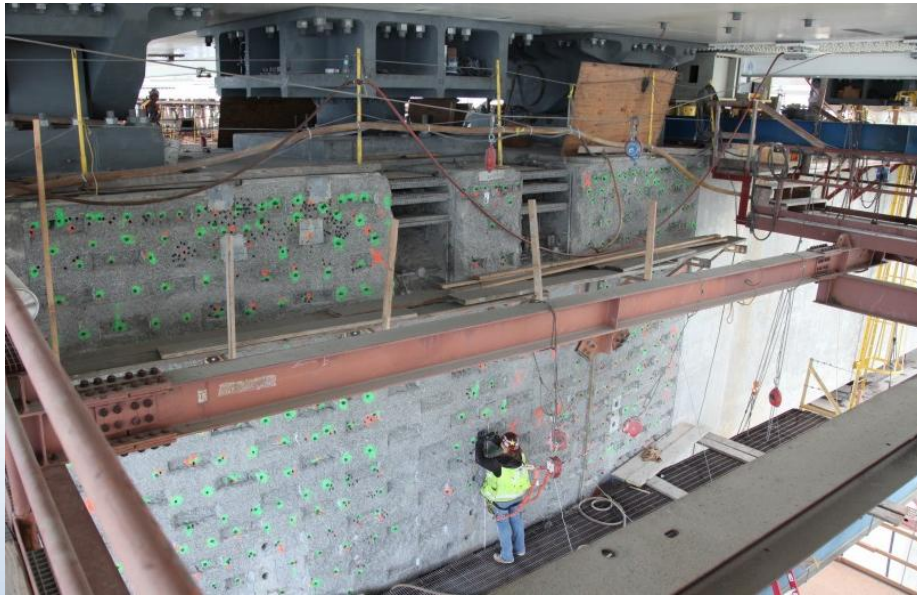


Rendering of Selected Steel Saddle Option



Status of Retrofit

- Fabrication on-going at XKT Engineering on Mare Island in Vallejo, CA and Steward Machine Co. in Birmingham, AL.
- Field preparation on-going with machining of shear key bases and concrete preparation of Pier E2 cap.



Retrofit Schedule & Bridge Opening

- The contractor's forecast for shear key retrofit completion is December 10, 2013
- The TBPOC will select bridge opening date based on retrofit completion, weather windows, and traffic impacts
- Bridge opening may not coincide with a Monday holiday weekend and will involve shorter advance notice to the public



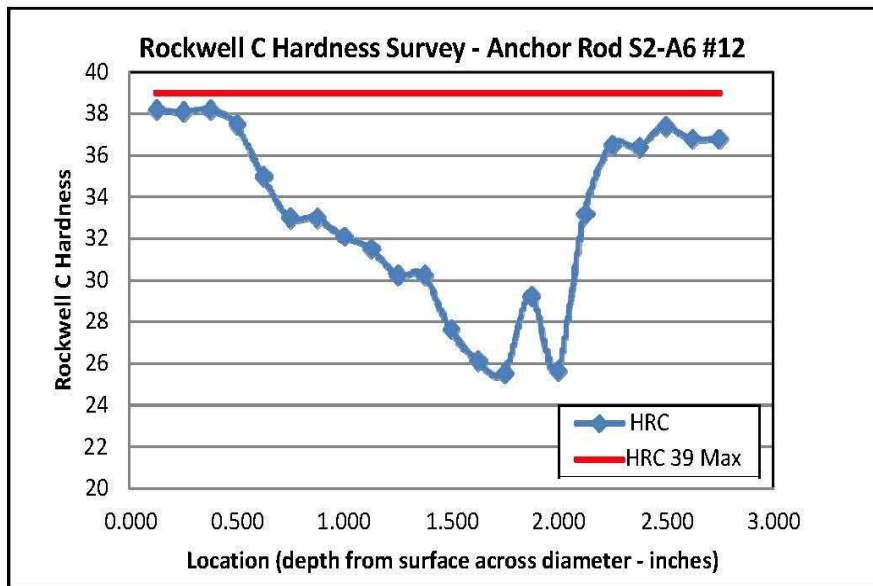
All Other Rods Performing As Designed Since Tensioning

Item #	Fabricator	End of Fabrication	Tension or Loading Complete	# of Rods Installed	# of Fractured Rods After Tensioning	Days Under Tension Through August 1, 2013
1	Dyson	Sep 2008	Mar 2013	96	32	Rods began failing after 3 days of tensioning
2	Dyson	Mar 2010	Apr 2013	192	0	122
3	Dyson	Mar 2010	Sep 2012	320	0	326
4	Dyson	Mar 2010	Sep 2012	224	0	323
5	Dyson	Aug 2009	Jun 2009	96	0	1,460
6	Dyson	Dec 2009	Jan 2010	336	0	1,276
7	Dyson	Nov 2011	Sep 2012	274	0	309
8	Dyson	Jul 2010	Jul 2012	25	0	382
9	Dyson	Jan 2011	Jul 2012	108	0	382
10	Dyson	Jan 2011	Mar 2013	90	0	128
11	Dyson	Oct 2011	Jul 2012	4	0	365
12	Vulcan Threaded Products	Feb 2007	Mar 2011	388	0	852
13	Vulcan Threaded Products	Feb 2007	Mar 2011	36	0	852
14	Dyson	Jun 2010	May 2010	32	0	1,156
15	Dyson	May 2010	Apr 2012	18	0	464
16	Dyson	Oct 2012	Feb 2013	24	0	173
17	Dyson	Jun 2009	In Design	43	0	-

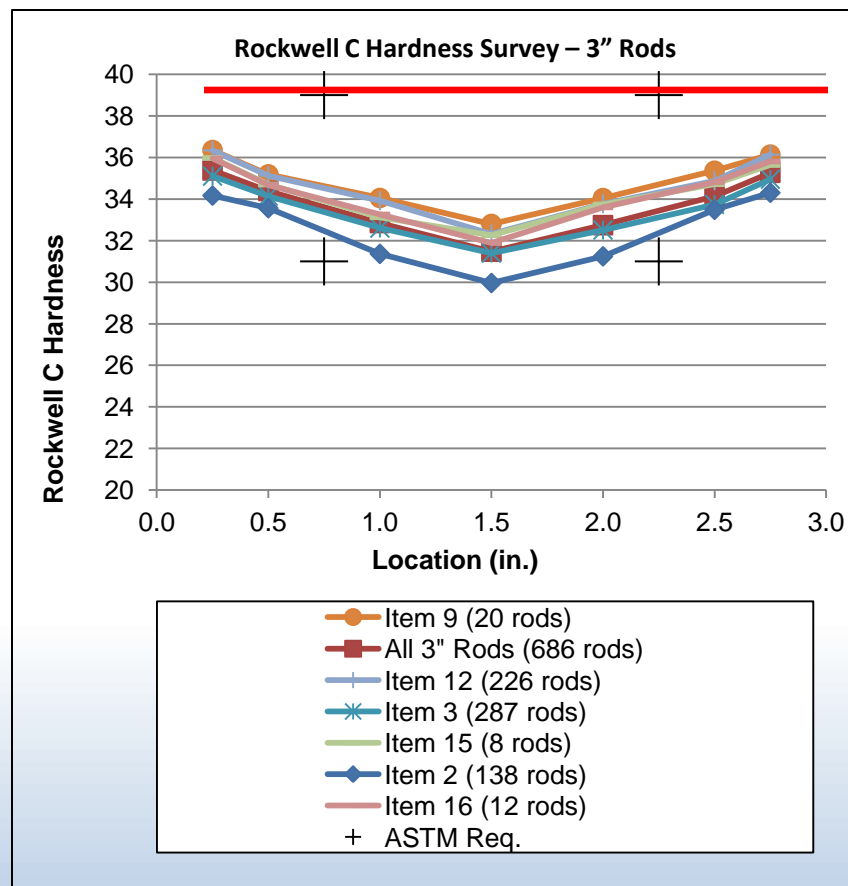


Improved Hardness

Failed 2008 Rod



Other 3" Rods



Rod By Rod Resolution (Provisional)

	Construction	Maintenance			
Location	Replace Before Opening (96)	Replace After Opening (740)	Reduce Tension (557)	Augment Dehumidification (274)	Accept and Monitor (639)
E2	1. Shear Key Anchor Rods (bottom) (96)* * replaced by steel saddle retrofit	2. Bearing & Shear Key Anchor Rods (bottom) (192) 3. Shear Key Rods (top) (320) 4. Bearing Rods (top) (224)			5. Bearing Assembly (96) 6. Bearing Retainer Ring Plate Assembly (336)
Anchorage				7. PWS Anchor Rods (274)	
Top of Tower		11. Outrigger Boom (4)	8. Saddle Tie Rods (25) 9. Saddle Turned Rods (108)		10. Saddle Grillage (90)
Bottom of Tower			12. Tower Anchor Rods (Type 1) (388) 13. Tower Anchor Rods (Type 2) (36)		
East Saddle					14. East Saddle Anchor Rods (32) 15. East Saddle Tie Rods (18)
East Cable					16. Cable Band Anchor Rod (24)
W2					17. Bikepath Anchor Rods – (43)

Note: Dehumidification is already in place for the Top of Tower, Bottom of Tower and Main Cable Anchorage.

Bottom Line

- The risk of near-term hydrogen embrittlement has passed.
- The longer-term stress corrosion can be managed safely and effectively after the SAS is placed into service.
- For now the TBPOC has determined it is safe to open the new East Span after replacing the capacity lost by the failed 2008 rods.

